PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-276340

(43)Date of publication of application : 25.09.2002

(51)Int.Cl. F01N 3/02
F01D 17/16
F01N 3/24
F02B 37/24
F02B 37/18
F02B 37/12
F02D 23/00
F02D 23/02
F02D 41/04
F02D 41/38
F02D 43/00
// B01D 46/42
B01D 46/44

(21)Application number : 2001-083560

(22)Date of filing : 22.03.2001

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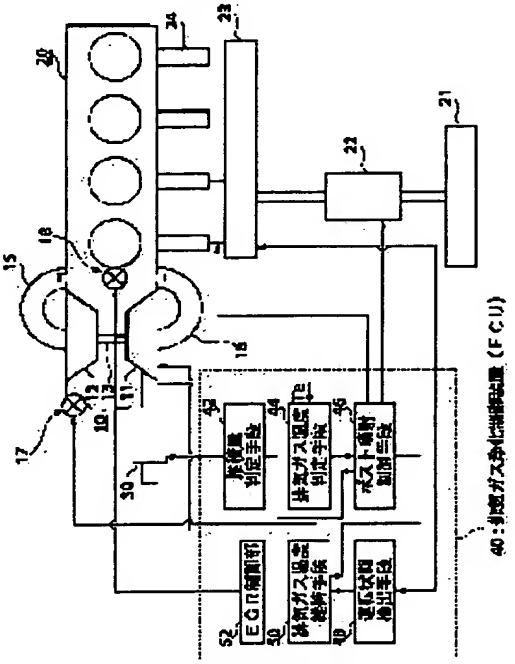
(54) EXHAUST EMISSION CONTROL DEVICE AND EXHAUST EMISSION CONTROL METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To effectively utilize thermal energy generated in a post injection.

SOLUTION: This exhaust emission control device comprises: a post injection control means 46 which starts the post injection of a diesel engine 20 when a collection amount determination means 42 determinates that a particulate collection amount of a particulate filter 30 exceeds a predetermined threshold value and an exhaust gas temperature (Te) is lower than a predetermined post injection start temperature (Ter); an operating condition detection means 48 which detects an operating condition of the diesel engine 20; and an exhaust gas temperature maintaining means 50 which prevents a rotation speed of a turbocharger 10 from increasing when an engine speed of the diesel engine 20 detected in the operating condition detection means 48 is not more than middle speed, and the post injection is carried out in a low load operation condition.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] It has the particulate filter which carries out uptake of the particulate contained in the exhaust gas of the diesel power plant which has a turbocharger, and said diesel power plant. An alimentation judging means to judge whether the particulate alimentation of the; aforementioned particulate filter exceeded the predetermined threshold in the exhaust gas purge used for the engine which reproduces said particulate filter with the heat energy of said exhaust gas, An exhaust gas temperature judging means to judge whether the exhaust gas temperature (Te) of said diesel power plant is lower than predetermined postinjection initiation temperature (Ter); Said particulate alimentation exceeds a predetermined threshold. And when said exhaust gas temperature is lower than said postinjection initiation temperature Postinjection of said diesel power plant The postinjection control means to start and an operational status detection means to detect the operational status of the; aforementioned diesel power plant; when the rotational frequency of said diesel power plant detected with said operational status detection means performs postinjection by below medium speed and the operational status of low loading ; exhaust gas purge possessing the exhaust gas temperature maintenance means operated so that rotational frequency increase of said turbocharger may be prevented.
[Claim 2] Said exhaust gas temperature maintenance means is an exhaust gas purge given in; claim 1 which opens fully the adjustable nozzle or way SUTOGETOBARUBU prepared in said turbocharger when the engine speed of said diesel power plant performs postinjection by below medium speed and the operational status of low loading.
[Claim 3] An exhaust gas purge given in; claim 1 or claim 2 whose operational status of below medium speed and low loading the engine speed of said diesel power plant which operates said exhaust gas temperature maintenance means is the idling of said diesel power plant.
[Claim 4] An exhaust gas purge given in any of; claim 1 which consists of or or larger making a judgment than predetermined threshold differential pressure (dPr) thru/or claim 3 said alimentation judging means is in the differential pressure (dP) of the entrance-side exhaust pressure of a particulate filter, and an outlet side exhaust pressure.
[Claim 5] It has the particulate filter which carries out uptake of the particulate contained in the exhaust gas of the diesel power plant which has a turbocharger, and said diesel power plant. Said particulate filter with the heat energy of said exhaust gas In the exhaust gas purification approach used for the engine to reproduce ; Said particulate alimentation is larger than a predetermined threshold. or [that the particulate alimentation of said particulate filter exceeded the predetermined threshold] -- judging --; -- or [that the exhaust gas temperature (Te) of said diesel power plant is lower than predetermined postinjection initiation temperature (Ter)] -- judging --; -- And when said exhaust gas temperature is lower than said postinjection initiation temperature The; exhaust gas purification approach which postinjection of said diesel power plant is started and the engine speed of the; aforementioned diesel power plant judges in the operational status of below medium speed and low loading, and prevents engine-speed increase of said turbocharger when the engine speeds of the; aforementioned diesel power plant are below medium speed and low loading.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the exhaust gas purge and the exhaust gas purification approach of reproducing DPF (diesel particulate filter) efficiently especially also at the time of low loading like an idling about the equipment which carries out uptake of the minute solid particulate (particulate) contained in the exhaust gas of a diesel power plant, and incinerates it.
[0002]
[Description of the Prior Art] Compression ignition of the injected fuel is carried out by the diesel power plant. Moreover, since a particle will surely occur in exhaust gas if heterogeneous gaseous mixture is burned, it is next to impossible to design the diesel power plant out of which soot does not come theoretically. However, by the diesel power plant, particulate discharge is decreased below to the visible limitation by adopting a turbocharger (especially with an intercooler), for example.
[0003] However, need increase of the shipping freight traffic in a big city has caused overcrowding of an automobile. Then, even if one set of an one-set diesel-power-plant engine performs the cure against exhaust gas, since a lot of diesel-power-plant engines are operating, particulate total emission increases and environmental load-carrying capacity is exceeded in a huge overpopulated city in many cases. Then, in order to remove a particulate out of the exhaust gas of a diesel power plant, the car which carried the diesel power plant is equipped with the particulate filter.
[0004] The particulate filter is equipped with the porous wall which has not coated honeycomb structure. The particulate contained in exhaust gas is removed by getting it blocked in a part for the pore of a porous wall. Since the particulate by which uptake was carried out accumulates on a particulate filter, it is necessary to remove this deposited particulate at fixed spacing, and to reproduce a particulate filter. For example, the heat-treating method is used as this playback system. The heat-treating method connects the heater for particulate combustion of high power, raises the temperature of exhaust gas to about 700 degrees C, and burns a particulate.
[0005] However, since it causes aggravation of fuel consumption since this heat-treating method needs the heating energy of a heater, and it consists of two lines, playback and uptake, it has the technical problem that equipment becomes complicated greatly. Then, the equipment called the continuation playback mold DPF is developed briskly recently. This equipment lowers a particulate combustion temperature according to a catalyst, and reproduces it continuously with the heat energy of exhaust gas. Since it is not necessary to make it two lines again, it is more advantageous than not compulsive heating at a heater but DPF using the heat-treating method in the point of fuel consumption and a layout.
[0006]
[Problem(s) to be Solved by the Invention] However, playback is not performed in the degree region of low temperature where a catalyst does not activate the above-mentioned continuation playback mold DPF. Therefore, a particulate continued accumulating on the filter, exhaust gas pressure went up by the blinding of a filter, without being reproduced at the time of the low idling condition of an exhaust-gas temperature, or downward slope transit, and the technical problem that trouble was caused to the power engine performance occurred. Then, raising an exhaust-gas temperature to the activity temperature region of a catalyst by postinjection in such a case, and reproducing compulsorily is performed. However, with the engine equipped with the turbocharger, even if it raises an exhaust-gas temperature by postinjection with much trouble, it will be used for the work from which this heat energy raises the engine speed of a turbine, and has the technical problem that it will fall, the outlet temperature, i.e., the DPF inlet temperature, of a turbine. This invention solves the technical problem mentioned above, and it aims at providing an effective target with an available exhaust gas purge for the heat energy generated in postinjection.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, as shown in drawing 1 , the exhaust gas purge by this invention is equipped with the particulate filter 30 which carries out uptake of the particulate contained in the exhaust gas of the diesel power plant 20 which has a turbocharger 10, and a diesel power plant 20, and is used for the engine which reproduces a particulate filter 30 with the heat energy of said exhaust gas.
[0008] An alimentation judging means 42 to judge whether said exhaust gas purge exceeded the threshold predetermined in the particulate alimentation of a particulate filter 30, An exhaust gas temperature judging means 44 to judge whether the exhaust gas temperature (Te) of a diesel power plant 20 is lower than predetermined postinjection initiation temperature (Ter), The postinjection control means 46 which said particulate alimentation exceeds a predetermined threshold, and starts postinjection of a diesel power plant 20 when said exhaust gas temperature is lower than said postinjection initiation temperature, An operational status detection means 48 to detect the operational status of a diesel power plant 20, When the engine speed of the diesel power plant 20 detected with the operational status detection means 48 performs postinjection by below medium speed and the operational status of low loading, the exhaust gas temperature maintenance means 50 operated so that engine-speed increase of a turbocharger 10 may be prevented is provided.
[0009] Thus, it is good to consider as the configuration which it sets to the constituted exhaust gas purge, and the alimentation judging means 42 judges whether the particulate alimentation of a particulate filter 30 exceeded the predetermined threshold, and judges whether the differential pressure (dP) of the entrance-side exhaust pressure of a particulate filter 30 and an outlet side exhaust pressure is larger than predetermined threshold differential pressure (dPr). It judges whether the exhaust gas temperature judging means 44 has the exhaust gas temperature (Te) of a diesel power plant 20 lower than predetermined postinjection initiation temperature (Ter). The particulate alimentation of a particulate filter 30 exceeds a predetermined threshold, and the postinjection control means 46 starts postinjection of a diesel power plant 20, when the exhaust gas temperature of a diesel power plant 20 is lower than postinjection initiation temperature, and it makes exhaust gas temperature high to the regenerating temperature of a particulate filter 30.
[0010] The operational status detection means 48 detects the operational status of a diesel power plant 20, and the engine speeds of a

diesel power plant 20 are below medium speed and the operational status of low loading like an idling, for example, it has detected it in the condition that the need of the high load is carried out to the diesel power plant 20 like [at the time of acceleration]. The rotational frequencies of a diesel power plant 20 are below medium speed and the operational status of low loading, and when postinjection is performed by the postinjection control means 46, the exhaust gas temperature maintenance means 50 prevents rotational frequency increase of a turbocharger 10, burns the particulate deposited on the particulate filter 30, and is reproduced. As a configuration which prevents engine-speed increase of a turbocharger 10, you open fully the adjustable nozzle or way SUTOGETOBARUBU prepared, for example in the turbocharger 10, and it is made for the energy of exhaust gas not to make it consume to the turbine side of a turbocharger 10. On the other hand, when judged as the operational status by which the above output is needed to some extent for a diesel power plant 20 with the operational status detection means 48, it increases and the rotational frequency of a turbocharger 10 is made into high power.

[0011] In order to attain the above-mentioned purpose, the exhaust gas purification approach by this invention judges whether the particulate alimentation of a particulate filter 30 exceeded the predetermined threshold first, as shown in drawing 7 (S102). For example, by judging whether the differential pressure (dP) of the entrance-side exhaust pressure of a particulate filter 30 and an outlet side exhaust pressure is larger than predetermined threshold differential pressure (dPr), particulate alimentation is measured indirectly. Next, it judges whether the exhaust gas temperature (Te) of a diesel power plant 20 is lower than predetermined postinjection initiation temperature (Ter) (S104). And more greatly than a threshold predetermined in particulate alimentation, when exhaust gas temperature is lower than postinjection initiation temperature, postinjection of a diesel power plant 20 is started (S106). Next, it judges whether the rotational frequencies of a diesel power plant 20 are below medium speed and the operational status of low loading (S108), and in corresponding, a measure required to prevent rotational frequency increase of a turbocharger is taken, and it opens fully the adjustable nozzle or way SUTOGETOBARUBU prepared in the turbocharger 10 (S110).

[0012]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing. In addition, in each drawing, the same or the explanation which attached the same sign or the similar sign at the corresponding member, and overlapped is omitted mutually. Drawing 1 is a block diagram explaining the gestalt of operation of the exhaust gas purge used for the diesel power plant of this invention.

[0013] In drawing, the fuel stored in the fuel tank 21 is stored in the fuel rail 23 with a pump 22. The fuel rail 23 is also called a common rail, it is a form independent of an engine speed and the fuel amount of supply, and generates an injection pressure and has heightened the average injection pressure. An injector 24 injects the opening time defined by ECU (Electric Control Unit) and the fuel oil consumption which becomes settled from the fuel pressure from the fuel rail 23 to the combustion chamber of a diesel power plant 20.

[0014] The turbocharger 10 is equipped with the exhaust air drive turbine 11 which transforms the energy in the exhaust gas of a diesel power plant 20 into mechanical energy, and the compressor 12 which compresses inhalation air. While specific fuel consumption is remarkably improved with the engine using a turbocharger 10 as compared with the natural aspiration engine of the same output, exhaust gas concentration is also improved. A shaft 13 conducts rotation of the exhaust air drive turbine 11 to a compressor 12.

[0015] An inlet manifold 15 is a duct for supplying the air compressed by the compressor 12 to the combustion chamber of a diesel power plant 20. An exhaust manifold 16 is a duct for supplying exhaust gas to the exhaust air drive turbine 11 from the combustion chamber of a diesel power plant 20. The intake throttle 17 is the throttle valve of the inhalation air of a compressor 12. EGR valve 18 is a bulb which is prepared in the last section of an EGR (Exhaust Gas Recirculation) path, and controls the amount of exhaust gas recycling. Here, EGR introduces and carries out recycling of a part of exhaust gas to an inhalation network, by mixing in gaseous mixture, lowers combustion temperature and reduces the yield of Nox. DPF30 is a particulate filter, needs to remove the deposited particulate at fixed spacing, and needs to reproduce a particulate filter while it carries out uptake of the particulate contained in exhaust gas.

[0016] ECU is equipped with the program required for the electronic circuitry as an exhaust gas purification control unit 40, or actuation of a microprocessor while it performs the combustion control of a diesel power plant 20. The exhaust gas purification control unit 40 equips the alimentation judging means 42, the exhaust gas temperature judging means 44, the postinjection control means 46, the operational status detection means 48, the exhaust gas temperature maintenance means 50, and the list with the EGR control section 52.

[0017] The alimentation judging means 42 judges whether the particulate alimentation of a particulate filter 30 exceeded the predetermined threshold, and judges whether the differential pressure dP of the entrance-side exhaust pressure of a particulate filter 30 and an outlet side exhaust pressure is larger than the predetermined threshold differential pressure dPr. The predetermined threshold differential pressure dPr judges that the particulate amount deposited on the particulate filter 30 reached to the reproductive complement. the differential pressure dP of the entrance-side exhaust pressure of a particulate filter 30, and an outlet side exhaust pressure -- differential pressure sensors, such as a semi-conductor type, -- dependability -- it can measure highly. In addition, the particulate alimentation of a particulate filter 30 may be replaced with a differential pressure type, and you may measure by the weight formula, and a deposition condition may be checked by looking using a visual sensor and it may measure that the particulate amount of the exhaust gas which penetrated the particulate filter 30 further is not decreasing enough.

[0018] It judges whether the exhaust gas temperature judging means 44 has exhaust gas temperature Te of a diesel power plant 20 lower than the predetermined postinjection initiation temperature Ter. Measurement of exhaust gas temperature Te is measured by the sensor from which resistance changes according to temperature like a resistance bulb, and is measured with the thermometer of other formats like an infrared type thermometer. The postinjection initiation temperature Ter is defined on the basis of exhaust gas temperature required for playback of a particulate filter 30.

[0019] The particulate alimentation of a particulate filter 30 exceeds a predetermined threshold, and the postinjection control means 46 starts postinjection of a diesel power plant 20, when the exhaust gas temperature of a diesel power plant 20 is lower than postinjection initiation temperature. Drawing 2 is the timing chart of the fuel injection injected by the combustion chamber of a diesel power plant from an injector. There are pilot injection, Maine injection, and postinjection as timing of fuel injection. The timing of fuel injection is defined by ECU.

[0020] The operational status detection means 48 detects the operational status of a diesel power plant 20, and the engine speeds of a diesel power plant 20 are below medium speed and the operational status of low loading like [at the time of an idling or downward slope transit], for example, it has detected it in the condition that the need of the high load is carried out to the diesel power plant 20 like [at the time of acceleration]. Drawing 3 is the explanatory view of the operational status of a diesel power plant, Torque Nm is shown on an axis of ordinate, and engine-speed rpm is shown on the axis of abscissa. a operating range E1 -- the high engine-speed field of a diesel power plant, and a list -- an inside low engine-speed field -- it is -- the crown -- the usual operating range of the diesel power plant at the time of running a truck and a bus is shown including the torque field. The rotational frequencies of a diesel power

plant 20 are below medium speed and the operational status of low loading like an idling or moderation operation at the time of a light load in the medium-speed low torque field E2.
[0021] It returns to drawing 1 again and explanation is continued. The exhaust gas temperature raised by postinjection prevents it being changed into the mechanical energy of a turbocharger 10, and falling again, burns the particulate deposited on the particulate filter 30, and reproduces the exhaust gas temperature maintenance means 50. Since exhaust gas temperature is lower than the temperature suitable for playback of a particulate filter when an engine load like an idling is light, it is necessary to raise exhaust gas temperature to the temperature suitable for playback of a particulate filter. Then, it checks whether the rotational frequencies of a diesel power plant 20 are below medium speed and the operational status of low loading with the operational status detection means 48. When judged as the operational status by which the above output is needed to some extent for a diesel power plant 20 with the operational status detection means 48, it increases and the rotational frequency of a turbocharger 10 is made into high power.
[0022] When it is checked that the rotational frequencies of a diesel power plant 20 are below medium speed and the operational status of low loading and postinjection is further performed by the operational status detection means 48, the exhaust gas temperature maintenance means 50 prevents rotational frequency increase of a turbocharger 10, and prevents rotational frequency increase of a turbocharger 10. You specifically open fully the adjustable nozzle or way SUTOGETOBARUBU prepared in the turbocharger 10, and it is made for the energy of exhaust gas not to make it consume to the turbine side of a turbocharger 10.
[0023] Drawing 4 is the block diagram of an adjustable blade type turbine. As for the adjustable blade type turbine, the guide blade 64 as an adjustable nozzle which can be adjusted is formed near the air inhalation opening 66 of the turbine housing 61. The guide blade 64 which can be adjusted is controlled according to the exhaust gas flow rate and gas rate which flow to a turbine impeller, and a turbine rotational frequency is maintained in a supercharge scope. Rotation of an adjust ring 62 can adjust easily the include angle of the guide blade 64 which can be adjusted. Adjustment of an include angle is performed by the conte roll cam 63 or the adjusting lever 65 attached to each blade.
[0024] Drawing 5 is the explanatory view of the charge pressure adjustment by way SUTOGETOBARUBU. Way SUTOGETOBARUBU 73 was formed in the exhaust pipe 74 which connects an engine 71 and a turbocharger 72, and has changed the condition of performing an air bypass and discharging the exhaust gas of an engine 71 in the direct open air without a turbocharger 72, and the condition of supplying a turbocharger 72.
[0025] Drawing 6 is drawing which explains relation with the working state of an exhaust gas temperature maintenance means to the existence list of exhaust gas temperature and postinjection. ** The bar graph shown by "W/o post injection" shows the condition of not performing postinjection, and exhaust gas temperature is the lowest. ** Although the condition of performing postinjection is shown and exhaust gas temperature is higher than the condition of not performing postinjection, the bar graph shown by "W/post injection" does not have the enough rise of exhaust gas temperature, in order that a turbocharger may work. ** The bar graph shown by "W/post injection & full open VNT or WG" shows the condition of opening fully the adjustable nozzle or way SUTOGETOBARUBU (WG) prepared in the turbocharger 10 by the exhaust gas temperature maintenance means while performing postinjection, and exhaust gas temperature is the highest. It becomes the temperature which exhaust gas temperature burns the particulate deposited on the particulate filter 30, and can reproduce by using together postinjection and an exhaust gas temperature maintenance means.
[0026] Thus, actuation of the constituted equipment is explained below. Drawing 7 is a flow chart explaining actuation of the equipment of drawing 1 . First, the exhaust gas purification control device 40 starts the regeneration program of a particulate filter prepared in ECU a fixed period (S100). It judges whether the differential pressure (dP) of the entrance-side exhaust pressure of a particulate filter 30 and an outlet side exhaust pressure is larger than predetermined threshold differential pressure (dPr) (S102). Here, the particulate alimentation of a particulate filter 30 judges indirectly whether the predetermined threshold was exceeded by measuring the differential pressure of the entrance-side exhaust pressure of a particulate filter 30, and an outlet side exhaust pressure.
[0027] Next, it judges whether the exhaust gas temperature (Te) of a diesel power plant 20 is lower than predetermined postinjection initiation temperature (Ter) (S104). And more greatly than a threshold predetermined in particulate alimentation, when exhaust gas temperature is lower than postinjection initiation temperature, postinjection of a diesel power plant 20 is started (S106). Next, it judges whether the rotational frequencies of a diesel power plant 20 are below medium speed and the operational status of low loading (S108). Specifically, it judges whether there are few engine speeds (Rpm) rather than the predetermined engine speed (Rpmr) as which the total fuel injection quantity (Q) by the injector 24 was similarly beforehand determined by experiment few from the predetermined fuel oil consumption (Qr) beforehand defined by experiment. And in corresponding to S108, it opens fully the adjustable nozzle or way SUTOGETOBARUBU prepared in the turbocharger 10 (S110). And it escapes from processing (S112).
[0028]
[Effect of the Invention] As explained above, since the exhaust gas purge of this invention judges whether the predetermined threshold used as those criteria for which the particulate alimentation of a particulate filter needs playback with an alimentation judging means was exceeded, the stage when a particulate filter should be reproduced can judge it exactly. Since postinjection of a diesel power plant is started by the postinjection control means while exhaust gas temperature Te of a diesel power plant judges whether it is lower than the predetermined postinjection initiation temperature Ter with an exhaust gas temperature judging means, exhaust gas temperature can be held to the suitable temperature for particulate filter playback. Since it is controlling so that the exhaust gas temperature which prevented engine-speed increase of a turbocharger and rose by postinjection is not lost with a turbocharger when the engine speed of a diesel power plant performs postinjection by below medium speed and the operational status of low loading with an exhaust gas temperature maintenance means, a particulate filter is reproducible.
[0029] For example, the time of an idling has the rotational frequency of a diesel power plant as below medium speed and operational status of low loading. For example, at the time of an idling, to being about 20 [mg/m3], a particulate yield is about 200 [mg/m3], and there is an about 10 times as many aperture as this depending on the operation mode of a diesel-power-plant car at the time of the maximum output. although the exhaust gas temperature at the time of an idling is markedly boiled as compared with 100-200 degrees C and 550-750 degrees C at the time of the maximum output and is low temperature, it can be made to go up to the temperature to which exhaust gas temperature of the operational status of below medium speed and low loading is made as for playback of a particulate filter by the engine speed of a diesel power plant by operation of this invention Then, without being used for the work from which the heat energy by postinjection raises the rotational frequency of a turbine in the time of the low idling condition of an exhaust-gas temperature, or downward slope transit, the engine equipped with the turbocharger can also raise an exhaust-gas temperature to the activity temperature region of a catalyst by postinjection, and can reproduce a particulate filter compulsorily.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the exhaust gas purge and the exhaust gas purification approach of reproducing DPF (diesel particulate filter) efficiently especially also at the time of low loading like an idling about the equipment which carries out uptake of the minute solid particulate (particulate) contained in the exhaust gas of a diesel power plant, and incinerates it.
[0002]
[Description of the Prior Art] Compression ignition of the injected fuel is carried out by the diesel power plant. Moreover, since a particle will surely occur in exhaust gas if heterogeneous gaseous mixture is burned, it is next to impossible to design the diesel power plant out of which soot does not come theoretically. However, by the diesel power plant, particulate discharge is decreased below to the visible limitation by adopting a turbocharger (especially with an intercooler), for example.
[0003] However, need increase of the shipping freight traffic in a big city has caused overcrowding of an automobile. Then, even if one set of an one-set diesel-power-plant engine performs the cure against exhaust gas, since a lot of diesel-power-plant engines are operating, particulate total emission increases and environmental load-carrying capacity is exceeded in a huge overpopulated city in many cases. Then, in order to remove a particulate out of the exhaust gas of a diesel power plant, the car which carried the diesel power plant is equipped with the particulate filter.
[0004] The particulate filter is equipped with the porous wall which has not coated honeycomb structure. The particulate contained in exhaust gas is removed by getting it blocked in a part for the pore of a porous wall. Since the particulate by which uptake was carried out accumulates on a particulate filter, it is necessary to remove this deposited particulate at fixed spacing, and to reproduce a particulate filter. For example, the heat-treating method is used as this playback system. The heat-treating method connects the heater for particulate combustion of high power, raises the temperature of exhaust gas to about 700 degrees C, and burns a particulate.
[0005] However, since it causes aggravation of fuel consumption since this heat-treating method needs the heating energy of a heater, and it consists of two lines, playback and uptake, it has the technical problem that equipment becomes complicated greatly. Then, the equipment called the continuation playback mold DPF is developed briskly recently. This equipment lowers a particulate combustion temperature according to a catalyst, and reproduces it continuously with the heat energy of exhaust gas. Since it is not necessary to make it two lines again, it is more advantageous than not compulsive heating at a heater but DPF using the heat-treating method in the point of fuel consumption and a layout.
[0006]
[Problem(s) to be Solved by the Invention] However, playback is not performed in the degree region of low temperature where a catalyst does not activate the above-mentioned continuation playback mold DPF. Therefore, a particulate continued accumulating on the filter, exhaust gas pressure went up by the blinding of a filter, without being reproduced at the time of the low idling condition of an exhaust-gas temperature, or downward slope transit, and the technical problem that trouble was caused to the power engine performance occurred. Then, raising an exhaust-gas temperature to the activity temperature region of a catalyst by postinjection in such a case, and reproducing compulsorily is performed. However, with the engine equipped with the turbocharger, even if it raises an exhaust-gas temperature by postinjection with much trouble, it will be used for the work from which this heat energy raises the engine speed of a turbine, and has the technical problem that it will fall, the outlet temperature, i.e., the DPF inlet temperature, of a turbine. This invention solves the technical problem mentioned above, and it aims at providing an effective target with an available exhaust gas purge for the heat energy generated in postinjection.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, as shown in drawing 1 , the exhaust gas purge by this invention is equipped with the particulate filter 30 which carries out uptake of the particulate contained in the exhaust gas of the diesel power plant 20 which has a turbocharger 10, and a diesel power plant 20, and is used for the engine which reproduces a particulate filter 30 with the heat energy of said exhaust gas.
[0008] An alimentation judging means 42 to judge whether said exhaust gas purge exceeded the threshold predetermined in the particulate alimentation of a particulate filter 30, An exhaust gas temperature judging means 44 to judge whether the exhaust gas temperature (Te) of a diesel power plant 20 is lower than predetermined postinjection initiation temperature (Ter), The postinjection control means 46 which said particulate alimentation exceeds a predetermined threshold, and starts postinjection of a diesel power plant 20 when said exhaust gas temperature is lower than said postinjection initiation temperature, An operational status detection means 48 to detect the operational status of a diesel power plant 20, When the engine speed of the diesel power plant 20 detected with the operational status detection means 48 performs postinjection by below medium speed and the operational status of low loading, the exhaust gas temperature maintenance means 50 operated so that engine-speed increase of a turbocharger 10 may be prevented is provided.
[0009] Thus, it is good to consider as the configuration which it sets to the constituted exhaust gas purge, and the alimentation judging means 42 judges whether the particulate alimentation of a particulate filter 30 exceeded the predetermined threshold, and judges whether the differential pressure (dP) of the entrance-side exhaust pressure of a particulate filter 30 and an outlet side exhaust pressure is larger than predetermined threshold differential pressure (dPr). It judges whether the exhaust gas temperature judging means 44 has the exhaust gas temperature (Te) of a diesel power plant 20 lower than predetermined postinjection initiation temperature (Ter). The particulate alimentation of a particulate filter 30 exceeds a predetermined threshold, and the postinjection control means 46 starts postinjection of a diesel power plant 20, when the exhaust gas temperature of a diesel power plant 20 is lower than postinjection initiation temperature, and it makes exhaust gas temperature high to the regenerating temperature of a particulate filter 30.
[0010] The operational status detection means 48 detects the operational status of a diesel power plant 20, and the engine speeds of a

diesel power plant 20 are below medium speed and the operational status of low loading like an idling, for example, it has detected it in the condition that the need of the high load is carried out to the diesel power plant 20 like [at the time of acceleration]. The rotational frequencies of a diesel power plant 20 are below medium speed and the operational status of low loading, and when postinjection is performed by the postinjection control means 46, the exhaust gas temperature maintenance means 50 prevents rotational frequency increase of a turbocharger 10, burns the particulate deposited on the particulate filter 30, and is reproduced. As a configuration which prevents engine-speed increase of a turbocharger 10, you open fully the adjustable nozzle or way SUTOGETOBARUBU prepared, for example in the turbocharger 10, and it is made for the energy of exhaust gas not to make it consume to the turbine side of a turbocharger 10. On the other hand, when judged as the operational status by which the above output is needed to some extent for a diesel power plant 20 with the operational status detection means 48, it increases and the rotational frequency of a turbocharger 10 is made into high power.

[0011] In order to attain the above-mentioned purpose, the exhaust gas purification approach by this invention judges whether the particulate alimentation of a particulate filter 30 exceeded the predetermined threshold first, as shown in drawing 7 (S102). For example, by judging whether the differential pressure (dP) of the entrance-side exhaust pressure of a particulate filter 30 and an outlet side exhaust pressure is larger than predetermined threshold differential pressure (dPr), particulate alimentation is measured indirectly. Next, it judges whether the exhaust gas temperature (Te) of a diesel power plant 20 is lower than predetermined postinjection initiation temperature (Ter) (S104). And more greatly than a threshold predetermined in particulate alimentation, when exhaust gas temperature is lower than postinjection initiation temperature, postinjection of a diesel power plant 20 is started (S106). Next, it judges whether the rotational frequencies of a diesel power plant 20 are below medium speed and the operational status of low loading (S108), and in corresponding, a measure required to prevent rotational frequency increase of a turbocharger is taken, and it opens fully the adjustable nozzle or way SUTOGETOBARUBU prepared in the turbocharger 10 (S110).

[0012]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing. In addition, in each drawing, the same or the explanation which attached the same sign or the similar sign at the corresponding member, and overlapped is omitted mutually. Drawing 1 is a block diagram explaining the gestalt of operation of the exhaust gas purge used for the diesel power plant of this invention.

[0013] In drawing, the fuel stored in the fuel tank 21 is stored in the fuel rail 23 with a pump 22. The fuel rail 23 is also called a common rail, it is a form independent of an engine speed and the fuel amount of supply, and generates an injection pressure and has heightened the average injection pressure. An injector 24 injects the opening time defined by ECU (Electric Control Unit) and the fuel oil consumption which becomes settled from the fuel pressure from the fuel rail 23 to the combustion chamber of a diesel power plant 20.

[0014] The turbocharger 10 is equipped with the exhaust air drive turbine 11 which transforms the energy in the exhaust gas of a diesel power plant 20 into mechanical energy, and the compressor 12 which compresses inhalation air. While specific fuel consumption is remarkably improved with the engine using a turbocharger 10 as compared with the natural aspiration engine of the same output, exhaust gas concentration is also improved. A shaft 13 conducts rotation of the exhaust air drive turbine 11 to a compressor 12.

[0015] An inlet manifold 15 is a duct for supplying the air compressed by the compressor 12 to the combustion chamber of a diesel power plant 20. An exhaust manifold 16 is a duct for supplying exhaust gas to the exhaust air drive turbine 11 from the combustion chamber of a diesel power plant 20. The intake throttle 17 is the throttle valve of the inhalation air of a compressor 12. EGR valve 18 is a bulb which is prepared in the last section of an EGR (Exhaust Gas Recirculation) path, and controls the amount of exhaust gas recycling. Here, EGR introduces and carries out recycling of a part of exhaust gas to an inhalation network, by mixing in gaseous mixture, lowers combustion temperature and reduces the yield of Nox. DPF30 is a particulate filter, needs to remove the deposited particulate at fixed spacing, and needs to reproduce a particulate filter while it carries out uptake of the particulate contained in exhaust gas.

[0016] ECU is equipped with the program required for the electronic circuitry as an exhaust gas purification control unit 40, or actuation of a microprocessor while it performs the combustion control of a diesel power plant 20. The exhaust gas purification control unit 40 equips the alimentation judging means 42, the exhaust gas temperature judging means 44, the postinjection control means 46, the operational status detection means 48, the exhaust gas temperature maintenance means 50, and the list with the EGR control section 52.

[0017] The alimentation judging means 42 judges whether the particulate alimentation of a particulate filter 30 exceeded the predetermined threshold, and judges whether the differential pressure dP of the entrance-side exhaust pressure of a particulate filter 30 and an outlet side exhaust pressure is larger than the predetermined threshold differential pressure dPr. The predetermined threshold differential pressure dPr judges that the particulate amount deposited on the particulate filter 30 reached to the reproductive complement. the differential pressure dP of the entrance-side exhaust pressure of a particulate filter 30, and an outlet side exhaust pressure -- differential pressure sensors, such as a semi-conductor type, -- dependability -- it can measure highly. In addition, the particulate alimentation of a particulate filter 30 may be replaced with a differential pressure type, and you may measure by the weight formula, and a deposition condition may be checked by looking using a visual sensor and it may measure that the particulate amount of the exhaust gas which penetrated the particulate filter 30 further is not decreasing enough.

[0018] It judges whether the exhaust gas temperature judging means 44 has exhaust gas temperature Te of a diesel power plant 20 lower than the predetermined postinjection initiation temperature Ter. Measurement of exhaust gas temperature Te is measured by the sensor from which resistance changes according to temperature like a resistance bulb, and is measured with the thermometer of other formats like an infrared type thermometer. The postinjection initiation temperature Ter is defined on the basis of exhaust gas temperature required for playback of a particulate filter 30.

[0019] The particulate alimentation of a particulate filter 30 exceeds a predetermined threshold, and the postinjection control means 46 starts postinjection of a diesel power plant 20, when the exhaust gas temperature of a diesel power plant 20 is lower than postinjection initiation temperature. Drawing 2 is the timing chart of the fuel injection injected by the combustion chamber of a diesel power plant from an injector. There are pilot injection, Maine injection, and postinjection as timing of fuel injection. The timing of fuel injection is defined by ECU.

[0020] The operational status detection means 48 detects the operational status of a diesel power plant 20, and the engine speeds of a diesel power plant 20 are below medium speed and the operational status of low loading like [at the time of an idling or downward slope transit], for example, it has detected it in the condition that the need of the high load is carried out to the diesel power plant 20 like [at the time of acceleration]. Drawing 3 is the explanatory view of the operational status of a diesel power plant, Torque Nm is shown on an axis of ordinate, and engine-speed rpm is shown on the axis of abscissa. a operating range E1 -- the high engine-speed field of a diesel power plant, and a list -- an inside low engine-speed field -- it is -- the crown -- the usual operating range of the diesel power plant at the time of running a truck and a bus is shown including the torque field. The rotational frequencies of a diesel power

plant 20 are below medium speed and the operational status of low loading like an idling or moderation operation at the time of a light load in the medium-speed low torque field E2.
[0021] It returns to drawing 1 again and explanation is continued. The exhaust gas temperature raised by postinjection prevents it being changed into the mechanical energy of a turbocharger 10, and falling again, burns the particulate deposited on the particulate filter 30, and reproduces the exhaust gas temperature maintenance means 50. Since exhaust gas temperature is lower than the temperature suitable for playback of a particulate filter when an engine load like an idling is light, it is necessary to raise exhaust gas temperature to the temperature suitable for playback of a particulate filter. Then, it checks whether the rotational frequencies of a diesel power plant 20 are below medium speed and the operational status of low loading with the operational status detection means 48. When judged as the operational status by which the above output is needed to some extent for a diesel power plant 20 with the operational status detection means 48, it increases and the rotational frequency of a turbocharger 10 is made into high power.
[0022] When it is checked that the rotational frequencies of a diesel power plant 20 are below medium speed and the operational status of low loading and postinjection is further performed by the operational status detection means 48, the exhaust gas temperature maintenance means 50 prevents rotational frequency increase of a turbocharger 10, and prevents rotational frequency increase of a turbocharger 10. You specifically open fully the adjustable nozzle or way SUTOGETOBARUBU prepared in the turbocharger 10, and it is made for the energy of exhaust gas not to make it consume to the turbine side of a turbocharger 10.
[0023] Drawing 4 is the block diagram of an adjustable blade type turbine. As for the adjustable blade type turbine, the guide blade 64 as an adjustable nozzle which can be adjusted is formed near the air inhalation opening 66 of the turbine housing 61. The guide blade 64 which can be adjusted is controlled according to the exhaust gas flow rate and gas rate which flow to a turbine impeller, and a turbine rotational frequency is maintained in a supercharge scope. Rotation of an adjust ring 62 can adjust easily the include angle of the guide blade 64 which can be adjusted. Adjustment of an include angle is performed by the conte roll cam 63 or the adjusting lever 65 attached to each blade.
[0024] Drawing 5 is the explanatory view of the charge pressure adjustment by way SUTOGETOBARUBU. Way SUTOGETOBARUBU 73 was formed in the exhaust pipe 74 which connects an engine 71 and a turbocharger 72, and has changed the condition of performing an air bypass and discharging the exhaust gas of an engine 71 in the direct open air without a turbocharger 72, and the condition of supplying a turbocharger 72.
[0025] Drawing 6 is drawing which explains relation with the working state of an exhaust gas temperature maintenance means to the existence list of exhaust gas temperature and postinjection. ** The bar graph shown by "W/o post injection" shows the condition of not performing postinjection, and exhaust gas temperature is the lowest. ** Although the condition of performing postinjection is shown and exhaust gas temperature is higher than the condition of not performing postinjection, the bar graph shown by "W/post injection" does not have the enough rise of exhaust gas temperature, in order that a turbocharger may work. ** The bar graph shown by "W/post injection & full open VNT or WG" shows the condition of opening fully the adjustable nozzle or way SUTOGETOBARUBU (WG) prepared in the turbocharger 10 by the exhaust gas temperature maintenance means while performing postinjection, and exhaust gas temperature is the highest. It becomes the temperature which exhaust gas temperature burns the particulate deposited on the particulate filter 30, and can reproduce by using together postinjection and an exhaust gas temperature maintenance means.
[0026] Thus, actuation of the constituted equipment is explained below. Drawing 7 is a flow chart explaining actuation of the equipment of drawing 1 . First, the exhaust gas purification control device 40 starts the regeneration program of a particulate filter prepared in ECU a fixed period (S100). It judges whether the differential pressure (dP) of the entrance-side exhaust pressure of a particulate filter 30 and an outlet side exhaust pressure is larger than predetermined threshold differential pressure (dPr) (S102). Here, the particulate alimentation of a particulate filter 30 judges indirectly whether the predetermined threshold was exceeded by measuring the differential pressure of the entrance-side exhaust pressure of a particulate filter 30, and an outlet side exhaust pressure.
[0027] Next, it judges whether the exhaust gas temperature (Te) of a diesel power plant 20 is lower than predetermined postinjection initiation temperature (Ter) (S104). And more greatly than a threshold predetermined in particulate alimentation, when exhaust gas temperature is lower than postinjection initiation temperature, postinjection of a diesel power plant 20 is started (S106). Next, it judges whether the rotational frequencies of a diesel power plant 20 are below medium speed and the operational status of low loading (S108). Specifically, it judges whether there are few engine speeds (Rpm) rather than the predetermined engine speed (Rpmr) as which the total fuel injection quantity (Q) by the injector 24 was similarly beforehand determined by experiment few from the predetermined fuel oil consumption (Qr) beforehand defined by experiment. And in corresponding to S108, it opens fully the adjustable nozzle or way SUTOGETOBARUBU prepared in the turbocharger 10 (S110). And it escapes from processing (S112).
[0028]
[Effect of the Invention] As explained above, since the exhaust gas purge of this invention judges whether the predetermined threshold used as those criteria for which the particulate alimentation of a particulate filter needs playback with an alimentation judging means was exceeded, the stage when a particulate filter should be reproduced can judge it exactly. Since postinjection of a diesel power plant is started by the postinjection control means while exhaust gas temperature Te of a diesel power plant judges whether it is lower than the predetermined postinjection initiation temperature Ter with an exhaust gas temperature judging means, exhaust gas temperature can be held to the suitable temperature for particulate filter playback. Since it is controlling so that the exhaust gas temperature which prevented engine-speed increase of a turbocharger and rose by postinjection is not lost with a turbocharger when the engine speed of a diesel power plant performs postinjection by below medium speed and the operational status of low loading with an exhaust gas temperature maintenance means, a particulate filter is reproducible.
[0029] For example, the time of an idling has the rotational frequency of a diesel power plant as below medium speed and operational status of low loading. For example, at the time of an idling, to being about 20 [mg/m3], a particulate yield is about 200 [mg/m3], and there is an about 10 times as many aperture as this depending on the operation mode of a diesel-power-plant car at the time of the maximum output. although the exhaust gas temperature at the time of an idling is markedly boiled as compared with 100-200 degrees C and 550-750 degrees C at the time of the maximum output and is low temperature, it can be made to go up to the temperature to which exhaust gas temperature of the operational status of below medium speed and low loading is made as for playback of a particulate filter by the engine speed of a diesel power plant by operation of this invention Then, without being used for the work from which the heat energy by postinjection raises the rotational frequency of a turbine in the time of the low idling condition of an exhaust-gas temperature, or downward slope transit, the engine equipped with the turbocharger can also raise an exhaust-gas temperature to the activity temperature region of a catalyst by postinjection, and can reproduce a particulate filter compulsorily.

[Translation done.]

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a block diagram explaining the gestalt of operation of the exhaust gas purge used for the diesel power plant of this invention.
[Drawing 2] It is the timing chart of the fuel injection injected by the combustion chamber of a diesel power plant from an injector.
[Drawing 3] It is the explanatory view of the operational status of a diesel power plant.
[Drawing 4] It is the block diagram of an adjustable blade type turbine.
[Drawing 5] It is the explanatory view of the charge pressure adjustment by way SUTOGETOBARUBU.
[Drawing 6] It is drawing which explains relation with the working state of an exhaust gas temperature maintenance means to the existence list of exhaust gas temperature and postinjection.
[Drawing 7] It is a flow chart explaining actuation of the equipment of drawing 1 .
[Description of Notations]
10 Turbocharger
20 Diesel Power Plant
21 Fuel Tank (Fuel Tank)
22 Pump (Pump)
23 Fuel Rail (Common Rail)
24 Injector (Injector)
30 Particulate Filter (DPF)
40 Exhaust Gas Purification Control Unit (ECU)
42 Alimentation Judging Means
44 Exhaust Gas Temperature Judging Means
46 PostInjection Control Means
48 Operational Status Detection Means
50 Exhaust Gas Temperature Maintenance Means

[Translation done.]

* NOTICES *

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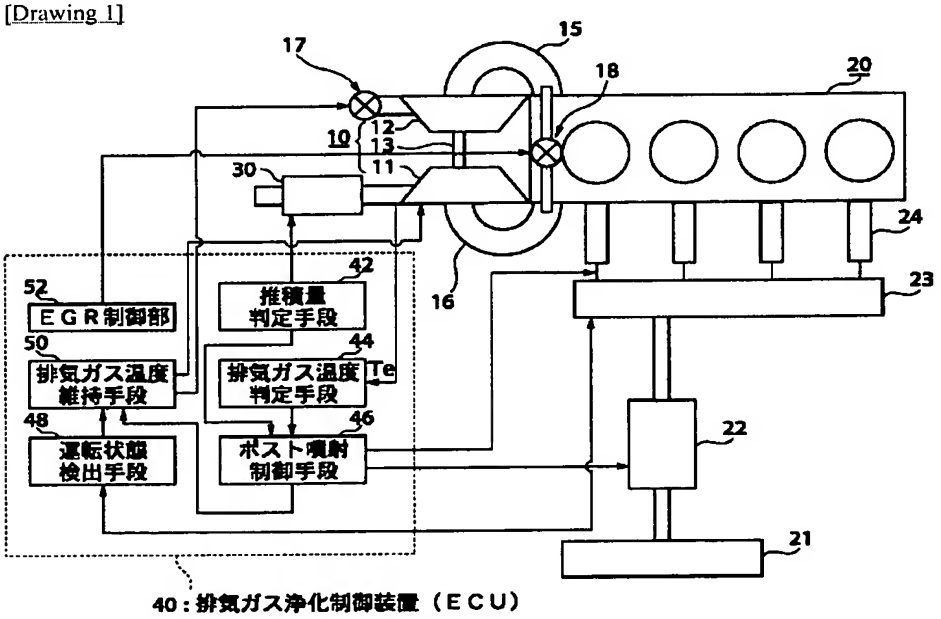
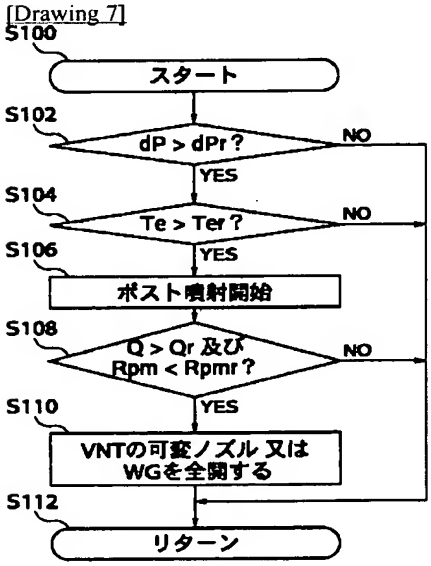
3.In the drawings, any words are not translated.

DRAWINGS

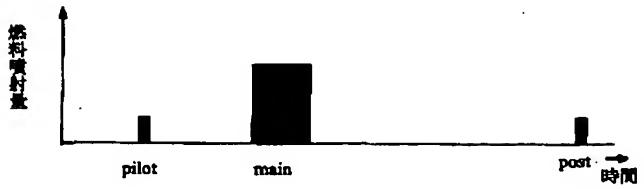
[Drawing 1]



[Drawing 7]



[Drawing 2]



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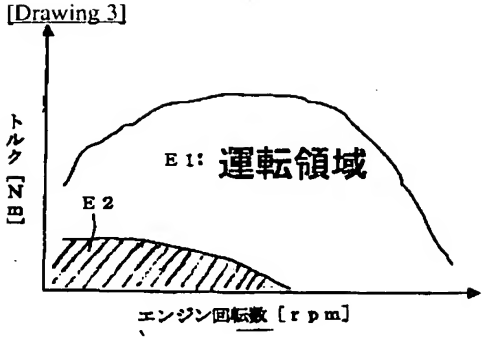

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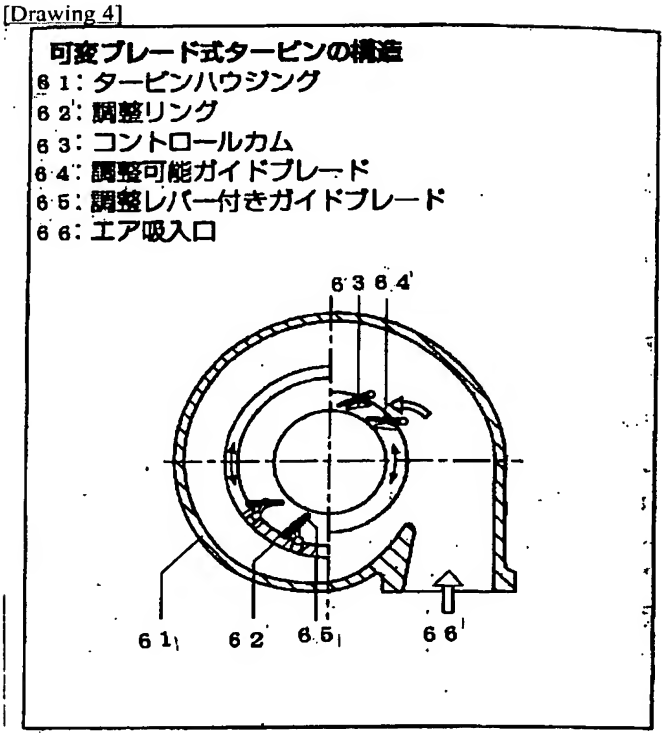
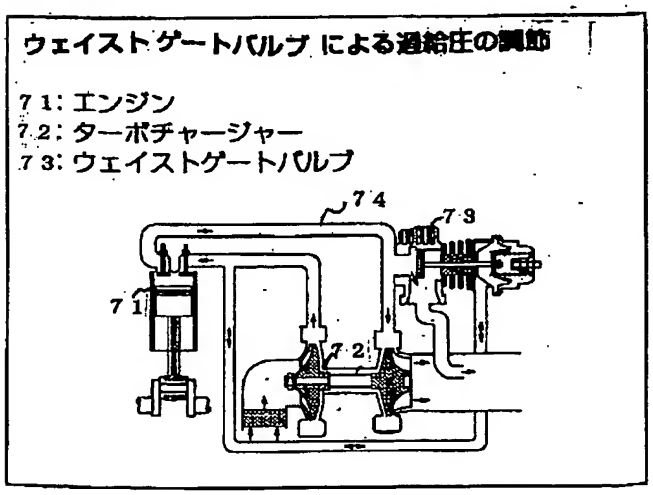
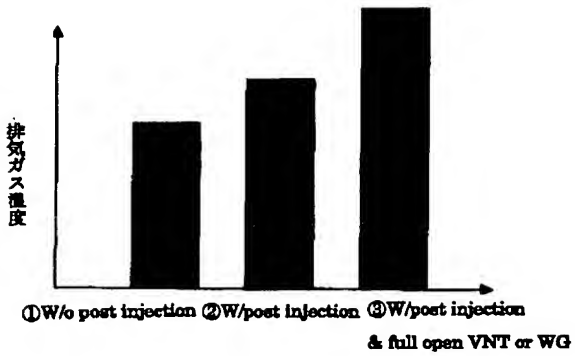


[Drawing 5]



[Drawing 6]



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Patent Abstracts of Japan

PUBLICATION NUMBER : 2002276340
PUBLICATION DATE : 25-09-02

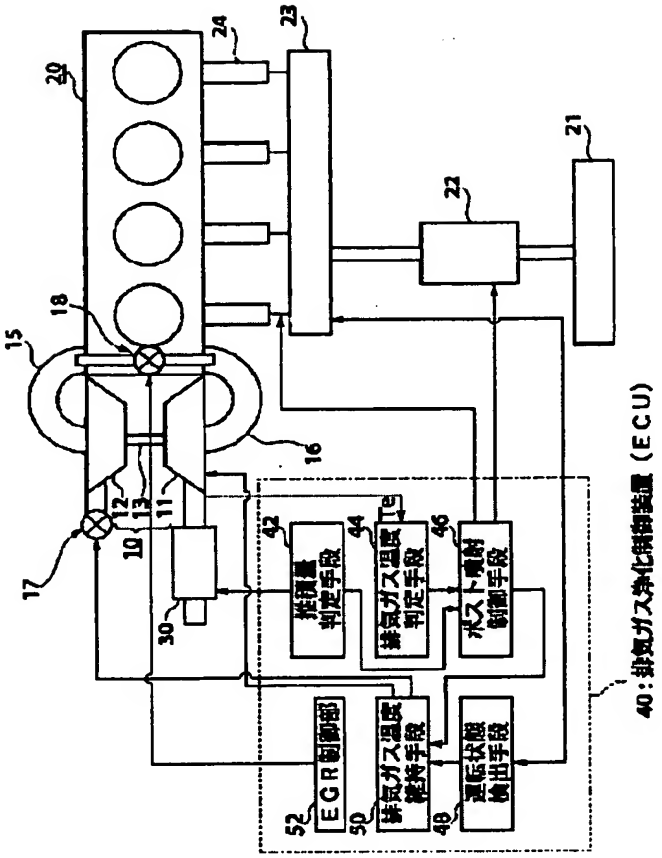
APPLICATION DATE : 22-03-01
APPLICATION NUMBER : 2001083560

APPLICANT : ISUZU MOTORS LTD;

INVENTOR : CHO TAKI;

INT.CL. : F01N 3/02 F01D 17/16 F01N 3/24
F02B 37/24 F02B 37/18 F02B 37/12
F02D 23/00 F02D 23/02 F02D 41/04
F02D 41/38

TITLE : EXHAUST EMISSION CONTROL DEVICE AND EXHAUST EMISSION CONTROL METHOD



ABSTRACT : PROBLEM TO BE SOLVED: To effectively utilize thermal energy generated in a post injection.

SOLUTION: This exhaust emission control device comprises: a post injection control means 46 which starts the post injection of a diesel engine 20 when a collection amount determination means 42 determinates that a particulate collection amount of a particulate filter 30 exceeds a predetermined threshold value and an exhaust gas temperature (Te) is lower than a predetermined post injection start temperature (Ter); an operating condition detection means 48 which detects an operating condition of the diesel engine 20; and an exhaust gas temperature maintaining means 50 which prevents a rotation speed of a turbocharger 10 from increasing when an engine speed of the diesel engine 20 detected in the operating condition detection means 48 is not more than middle speed, and the post injection is carried out in a low load operation condition.

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開2002－276340
（P2002－276340A）
(43)公開日　平成14年９月25日(2002.9.25)

(51)Int.Cl.'	識別記号	ＦＩ		テーマコード（参考）
Ｆ０１Ｎ　3/02	３２１	Ｆ０１Ｎ　3/02	３２１Ａ	３Ｇ００５
			３２１Ｂ	３Ｇ０７１
			３２１Ｋ	３Ｇ０８４
Ｆ０１Ｄ　17/16		Ｆ０１Ｄ　17/16	Ａ	３Ｇ０９０
Ｆ０１Ｎ　3/24		Ｆ０１Ｎ　3/24	Ｔ	３Ｇ０９１

審査請求　未請求　請求項の数５　ＯＬ　（全８頁）　最終頁に続く

(21)出願番号　特願2001－83560(P2001－83560)

(22)出願日　平成13年３月22日(2001.3.22)

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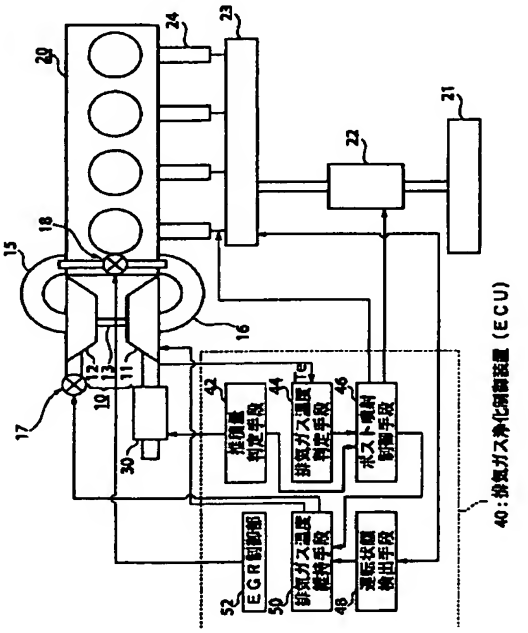
最終頁に続く

(54)【発明の名称】　排気ガス浄化装置、排気ガス浄化方法

(57)【要約】
【課題】　ポスト噴射で発生した熱エネルギーを有効的に利用可能な排気ガス浄化装置を提供する。
【解決手段】　堆積量判定手段４２でパティキュレート・フィルター３０のパティキュレート堆積量が所定の閾値を超えたと判断し、かつ排気ガス温度（Ｔｅ）が所定のポスト噴射開始温度（Ｔｅｒ）よりも低い場合に、ディーゼルエンジン２０のポスト噴射を開始するポスト噴射制御手段４６と、ディーゼルエンジン２０の運転状態を検出する運転状態検出手段４８と、運転状態検出手段４８で検出したディーゼルエンジン２０の回転数が中速以下且つ低負荷の運転状態でポスト噴射を実行する場合には、ターボチャージャー１０の回転数増大を阻止するように作動させる排気ガス温度維持手段５０とを具備する。



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【特許請求の範囲】

【請求項１】　ターボチャージャーを有するディーゼルエンジンと、前記ディーゼルエンジンの排気ガスに含まれるパティキュレートを捕集するパティキュレート・フィルターを備え、前記パティキュレート・フィルターを前記排気ガスの熱エネルギーにより再生するエンジンに用いられる排気ガス浄化装置において；前記パティキュレート・フィルターのパティキュレート堆積量が所定の閾値を超えたか判断する堆積量判定手段と、

前記ディーゼルエンジンの排気ガス温度（Ｔｅ）が所定のポスト噴射開始温度（Ｔｅｒ）よりも低いか判断する排気ガス温度判定手段と；前記パティキュレート堆積量が所定の閾値を超え、かつ前記排気ガス温度が前記ポスト噴射開始温度より低い場合に、前記ディーゼルエンジンのポスト噴射を開始するポスト噴射制御手段と；前記ディーゼルエンジンの運転状態を検出する運転状態検出手段と；前記運転状態検出手段で検出した前記ディーゼルエンジンの回転数が中速以下且つ低負荷の運転状態でポスト噴射を実行する場合には、前記ターボチャージャーの回転数増大を阻止するように作動させる排気ガス温度維持手段とを具備する；排気ガス浄化装置。

【請求項２】　前記排気ガス温度維持手段は、前記ディーゼルエンジンの回転数が中速以下且つ低負荷の運転状態でポスト噴射を実行する場合には、前記ターボチャージャーに設けられた可変ノズル若しくはウェイストゲートバルブを全開する；請求項１に記載の排気ガス浄化装置。

【請求項３】　前記排気ガス温度維持手段を作動させる前記ディーゼルエンジンの回転数が中速以下且つ低負荷の運転状態が、前記ディーゼルエンジンのアイドリングである；請求項１又は請求項２に記載の排気ガス浄化装置。

【請求項４】　前記堆積量判定手段が、パティキュレート・フィルターの入口側排気圧と出口側排気圧の差圧（ｄＰ）が所定のしきい値差圧（ｄＰｒ）よりも大きいか判断することからなる；請求項１乃至請求項３の何れかに記載の排気ガス浄化装置。

【請求項５】　ターボチャージャーを有するディーゼルエンジンと、前記ディーゼルエンジンの排気ガスに含まれるパティキュレートを捕集するパティキュレート・フィルターを備え、前記パティキュレート・フィルターを前記排気ガスの熱エネルギーにより再生するエンジンに用いられる排気ガス浄化方法において；前記パティキュレート・フィルターのパティキュレート堆積量が所定の閾値を超えたか判断し；前記ディーゼルエンジンの排気ガス温度（Ｔｅ）が所定のポスト噴射開始温度（Ｔｅｒ）よりも低いか判断し；前記パティキュレート堆積量が所定の閾値よりも大きく、かつ前記排気ガス温度が前記ポスト噴射開始温度よりは低い場合に、前記ディーゼルエンジンのポスト噴射を開始し；前記ディーゼルエンジンの回転数が中速以下且つ低負荷の運転状態か判断し；前記ディーゼルエンジンの回転数が中速以下且つ低負荷の場合には、前記ターボチャージャーの回転数増大を阻止する；排気ガス浄化方法。

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【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明はディーゼルエンジンの排気ガスに含まれる微小な固体粒子（パティキュレート）を捕集して焼却する装置に関し、特にアイドリングのような低負荷時にも効率良くＤＰＦ（ディーゼル・パティキュレート・フィルター）を再生する排気ガス浄化装置、排気ガス浄化方法に関する。

【０００２】

【従来の技術】ディーゼルエンジンでは、噴射した燃料を圧縮着火させている。また不均質な混合気を燃焼すると必ず排気ガス中に微粒子が発生するため、原理的に煤煙のでないディーゼルエンジンを設計することは不可能に近い。しかし、ディーゼルエンジンでは、例えばターボチャージャー（特にインタークーラー付き）を採用することで、パティキュレートの排出を可視限界以下まで減少させている。

【０００３】しかし、大都市における貨物輸送の需要増大は自動車の過密を招いている。そこで、一台一台のディーゼルエンジン機関が排気ガス対策を行っても、巨大な過密都市では多量のディーゼルエンジン機関が作動しているため、パティキュレートの総排出量が増大して環境負荷容量を超えてしまう場合が多い。そこで、ディーゼルエンジンの排気ガス中からパティキュレートを取り除くため、パティキュレート・フィルターがディーゼルエンジンを搭載した車両に装着されている。

【０００４】パティキュレート・フィルターは、例えばハニカム構造のコーティングしていない多孔壁を備えている。排気ガスに含まれるパティキュレートは、多孔壁の孔部分に詰まることによって取り除かれる。捕集されたパティキュレートがパティキュレート・フィルターに堆積するので、この堆積したパティキュレートを一定間隔で除去してパティキュレート・フィルターを再生する必要がある。この再生方式として、例えば熱処理法が用いられている。熱処理法は高出力のパティキュレート燃焼用ヒータを接続して、排気ガスの温度を約７００℃に上げて、パティキュレートを焼いてしまうものである。

【０００５】しかし、この熱処理法はヒータの加熱エネルギーを必要とするため、燃費の悪化を招き、また再生と捕集の二系統からなるため装置が大きく複雑になるという課題がある。そこで、最近は連続再生型ＤＰＦと呼ばれる装置が盛んに開発されている。この装置は触媒によってパティキュレートの燃焼温度を下げ、排気ガスの熱エネルギーによって連続的に再生するものである。ヒータによる強制加熱ではなく、また二系統にする必要もないので、燃費・レイアウトの点で熱処理法を用いたＤ

ＰＦより有利である。

【０００６】

【発明が解決しようとする課題】ところが、上述の連続再生型ＤＰＦは触媒が活性化しない低温度域においては再生が行われない。従って、排気温度の低いアイドリング状態や下り坂走行時には再生されずに、パティキュレートがフィルターに堆積されつづけ、フィルターの目詰まりにより排圧が上昇し動力性能に支障をきたすという課題があった。そこで、このような場合にポスト噴射により排気温度を触媒の活性温度域まで上げて、強制的に再生することが行われる。しかるに、ターボチャージャを備えたエンジンでは、せっかくポスト噴射によって排気温度を上げても、この熱エネルギーがタービンの回転数を上げる仕事に使われてしまい、タービンの出口温度すなわちＤＰＦ入口温度は低下してしまうという課題がある。本発明は上述する課題を解決するもので、ポスト噴射で発生した熱エネルギーを有効的に利用可能な排気ガス浄化装置を提供することを目的にしている。

【０００７】

【課題を解決するための手段】上記目的を達成するために、本発明による排気ガス浄化装置は、例えば図１に示すように、ターボチャージャー１０を有するディーゼルエンジン２０と、ディーゼルエンジン２０の排気ガスに含まれるパティキュレートを捕集するパティキュレート・フィルター３０を備え、パティキュレート・フィルター３０を前記排気ガスの熱エネルギーにより再生するエンジンに用いられる。

【０００８】前記排気ガス浄化装置は、パティキュレート・フィルター３０のパティキュレート堆積量が所定の閾値を超えたか判断する堆積量判定手段４２と、ディーゼルエンジン２０の排気ガス温度（Ｔｅ）が所定のポスト噴射開始温度（Ｔｅｒ）よりも低いか判断する排気ガス温度判定手段４４と、前記パティキュレート堆積量が所定の閾値を超え、かつ前記排気ガス温度が前記ポスト噴射開始温度より低い場合に、ディーゼルエンジン２０のポスト噴射を開始するポスト噴射制御手段４６と、ディーゼルエンジン２０の運転状態を検出する運転状態検出手段４８と、運転状態検出手段４８で検出したディーゼルエンジン２０の回転数が中速以下且つ低負荷の運転状態でポスト噴射を実行する場合には、ターボチャージャー１０の回転数増大を阻止するように作動させる排気ガス温度維持手段５０とを具備する。

【０００９】このように構成された排気ガス浄化装置において、堆積量判定手段４２は、パティキュレート・フィルター３０のパティキュレート堆積量が所定の閾値を超えたか判断するもので、例えばパティキュレート・フィルター３０の入口側排気圧と出口側排気圧の差圧（ｄＰ）が所定のしきい値差圧（ｄＰｒ）よりも大きいか判断する構成とするとよい。排気ガス温度判定手段４４は、ディーゼルエンジン２０の排気ガス温度（Ｔｅ）が所定のポスト噴射開始温度（Ｔｅｒ）よりも低いか判断する。ポスト噴射制御手段４６は、パティキュレート・フィルター３０のパティキュレート堆積量が所定の閾値を超え、かつディーゼルエンジン２０の排気ガス温度がポスト噴射開始温度より低い場合に、ディーゼルエンジン２０のポスト噴射を開始して、排気ガス温度をパティキュレート・フィルター３０の再生温度まで高くする。

【００１０】運転状態検出手段４８は、ディーゼルエンジン２０の運転状態を検出するもので、例えばアイドリングのようにディーゼルエンジン２０の回転数が中速以下且つ低負荷の運転状態であるか、加速時のようにディーゼルエンジン２０に高い負荷が必要されている状態か検出している。排気ガス温度維持手段５０は、ディーゼルエンジン２０の回転数が中速以下且つ低負荷の運転状態で、ポスト噴射制御手段４６によりポスト噴射が実行される場合には、ターボチャージャー１０の回転数増大を阻止して、パティキュレート・フィルター３０に堆積したパティキュレートを燃焼させて再生する。ターボチャージャー１０の回転数増大を阻止する構成としては、例えばターボチャージャー１０に設けられた可変ノズル若しくはウェイストゲートバルブを全開して、ターボチャージャー１０のタービン側に排気ガスのエネルギーが消費させないようにする。他方、運転状態検出手段４８でディーゼルエンジン２０にある程度以上の出力が必要とされる運転状態と判断された場合は、ターボチャージャー１０の回転数を増大して高出力としている。

【００１１】上記目的を達成するために、本発明による排気ガス浄化方法は、例えば図７に示すように、まずパティキュレート・フィルター３０のパティキュレート堆積量が所定の閾値を超えたか判断する（Ｓ１０２）。例えばパティキュレート・フィルター３０の入口側排気圧と出口側排気圧の差圧（ｄＰ）が所定のしきい値差圧（ｄＰｒ）よりも大きいか判断することで、パティキュレート堆積量を間接的に測定する。次に、ディーゼルエンジン２０の排気ガス温度（Ｔｅ）が所定のポスト噴射開始温度（Ｔｅｒ）よりも低いか判断する（Ｓ１０４）。そして、パティキュレート堆積量が所定の閾値よりも大きく、かつ排気ガス温度がポスト噴射開始温度よりは低い場合に、ディーゼルエンジン２０のポスト噴射を開始する（Ｓ１０６）。次に、ディーゼルエンジン２０の回転数が中速以下且つ低負荷の運転状態であるか判断し（Ｓ１０８）、該当する場合にはターボチャージャーの回転数増大を阻止するのに必要な措置をとるもので、例えばターボチャージャー１０に設けられた可変ノズル若しくはウェイストゲートバルブを全開する（Ｓ１１０）。

【００１２】

【発明の実施の形態】以下、本発明の実施の形態について、図面を参照して説明する。なお、各図において互いに同一あるいは相当する部材には同一符号または類似符

号を付し、重複した説明は省略する。図１は本発明のディーゼルエンジンに用いられる排気ガス浄化装置の実施の形態を説明する構成図である。

【００１３】図において、燃料タンク２１に蓄えられた燃料は、ポンプ２２により燃料レール２３に蓄えられる。燃料レール２３はコモンレールとも呼ばれ、エンジン回転数及び燃料供給量に依存しない形で、噴射圧力を発生させて平均噴射圧力を高めている。インジェクタ２４は、ＥＣＵ(Electric Control Unit)により定められた開き時間と燃料レール２３からの燃料圧力から定まる燃料噴射量を、ディーゼルエンジン２０の燃焼室に噴射する。

【００１４】ターボチャージャー１０は、ディーゼルエンジン２０の排気ガス中のエネルギーを機械エネルギーに変換する排気駆動タービン１１と、吸入空気を圧縮するコンプレッサ１２を備えている。同じ出力の自然吸気エンジンと比較して、ターボチャージャー１０を用いたエンジンでは、燃料消費率が著しく改善されると共に、排気ガス濃度も改善される。シャフト１３は、排気駆動タービン１１の回転運動をコンプレッサ１２に伝導する。

【００１５】吸気マニホルド１５は、コンプレッサ１２で圧縮された空気をディーゼルエンジン２０の燃焼室に供給する為の管路である。排気マニホルド１６は、ディーゼルエンジン２０の燃焼室から排気ガスを排気駆動タービン１１に供給する為の管路である。インテーク・スロットル１７は、コンプレッサ１２の吸入空気の絞り弁である。ＥＧＲバルブ１８は、ＥＧＲ(Exhaust Gas Recirculation)通路の最終部に設けられ、排気ガス再循環量をコントロールするバルブである。ここで、ＥＧＲは排気ガスの一部を吸入系統に導入して再循環させ、混合気に混入することによって燃焼温度を下げ、Ｎｏｘの発生量を低減させるものである。ＤＰＦ３０はパティキュレート・フィルターで、排気ガスに含まれるパティキュレートを捕集すると共に、堆積したパティキュレートを一定間隔で除去してパティキュレート・フィルターを再生する必要がある。

【００１６】ＥＣＵは、ディーゼルエンジン２０の燃焼制御を行うと共に、排気ガス浄化制御装置４０としての電子回路若しくはマイクロプロセッサの動作に必要なプログラムを備えている。排気ガス浄化制御装置４０は、堆積量判定手段４２、排気ガス温度判定手段４４、ポスト噴射制御手段４６、運転状態検出手段４８、排気ガス温度維持手段５０、並びにＥＧＲ制御部５２を備えている。

【００１７】堆積量判定手段４２は、パティキュレート・フィルター３０のパティキュレート堆積量が所定の閾値を超えたか判断するもので、例えばパティキュレート・フィルター３０の入口側排気圧と出口側排気圧の差圧ｄＰが所定のしきい値差圧ｄＰｒよりも大きいか判断する。所定のしきい値差圧ｄＰｒは、パティキュレート・フィルター３０に堆積したパティキュレートの量が、再生の必要な量まで達したことを判断するものである。パティキュレート・フィルター３０の入口側排気圧と出口側排気圧の差圧ｄＰは、半導体式などの差圧センサによって信頼性高く測定できる。なお、パティキュレート・フィルター３０のパティキュレート堆積量は差圧式に代えて、重量式で測定しても良く、また視覚センサを用いて堆積状態を視認しても良く、さらにパティキュレート・フィルター３０を透過した排気ガスのパティキュレートの量が充分減少していないことを測定するものでも良い。

【００１８】排気ガス温度判定手段４４は、ディーゼルエンジン２０の排気ガス温度Ｔｅが所定のポスト噴射開始温度Ｔｅｒよりも低いか判断する。排気ガス温度Ｔｅの測定は、例えば測温抵抗体のような温度に応じて抵抗値が変化するセンサで測定したり、また赤外線式温度計のような他の形式の温度計で測定する。ポスト噴射開始温度Ｔｅｒは、パティキュレート・フィルター３０の再生に必要な排気ガス温度を基準に定める。

【００１９】ポスト噴射制御手段４６は、パティキュレート・フィルター３０のパティキュレート堆積量が所定の閾値を超え、かつディーゼルエンジン２０の排気ガス温度がポスト噴射開始温度より低い場合に、ディーゼルエンジン２０のポスト噴射を開始する。図２はインジェクタからディーゼルエンジンの燃焼室に噴射される燃料噴射のタイミングチャートである。燃料噴射のタイミングとしては、パイロット噴射、メイン噴射、ポスト噴射がある。燃料噴射のタイミングはＥＣＵにより定められる。

【００２０】運転状態検出手段４８は、ディーゼルエンジン２０の運転状態を検出するもので、例えばアイドリングや下り坂走行時のようにディーゼルエンジン２０の回転数が中速以下且つ低負荷の運転状態であるか、加速時のようにディーゼルエンジン２０に高い負荷が必要されている状態か検出している。図３はディーゼルエンジンの運転状態の説明図で、縦軸にトルクＮｍ、横軸にエンジン回転数ｒｐｍを示している。運転領域Ｅ１は、ディーゼルエンジンの高回転数領域、並びに中低回転数領域であって中高トルク領域を含むもので、トラックやバスが走行する際におけるディーゼルエンジンの通常の運転領域を示している。中速低トルク領域Ｅ２は、アイドリングや軽負荷時の減速運転のようにディーゼルエンジン２０の回転数が中速以下且つ低負荷の運転状態である。

【００２１】再び図１に戻って説明を継続する。排気ガス温度維持手段５０は、ポスト噴射によって高められた排気ガス温度が、ターボチャージャー１０の機械エネルギーに変換されて再び低下するのを防止して、パティキュレート・フィルター３０に堆積したパティキュレート

を燃焼させて再生するものである。アイドリングのようなエンジン負荷の軽い場合には、排気ガス温度がパティキュレート・フィルターの再生に適する温度よりも低いため、排気ガス温度をパティキュレート・フィルターの再生に適する温度まで上昇させる必要がある。そこで、運転状態検出手段４８によってディーゼルエンジン２０の回転数が中速以下且つ低負荷の運転状態であるか否かを確認する。もし、運転状態検出手段４８でディーゼルエンジン２０にある程度以上の出力が必要とされる運転状態と判断された場合は、ターボチャージャー１０の回転数を増大して高出力としている。

【００２２】排気ガス温度維持手段５０は、運転状態検出手段４８によってディーゼルエンジン２０の回転数が中速以下且つ低負荷の運転状態であると確認され、さらにポスト噴射が実行される場合には、ターボチャージャー１０の回転数増大を阻止して、ターボチャージャー１０の回転数増大を阻止する。具体的には、ターボチャージャー１０に設けられた可変ノズル若しくはウェイストゲートバルブを全開して、ターボチャージャー１０のタービン側に排気ガスのエネルギーが消費させないようにする。

【００２３】図４は可変ブレード式タービンの構成図である。可変ブレード式タービンは、タービンハウジング６１のエア吸入口６６の近傍に可変ノズルとしての調整可能ガイドブレード６４が設けてある。タービンインペラーに流れる排気ガス流量やガス速度に合わせて調整可能ガイドブレード６４が制御され、タービン回転数が過給有効範囲に維持される。調整リング６２の回転により、調整可能ガイドブレード６４の角度を容易に調整できる。角度の調整はコントロールカム６３、または夫々のブレードに付属している調整レバー６５により行われる。

【００２４】図５はウェイストゲートバルブによる過給圧調整の説明図である。ウェイストゲートバルブ７３は、エンジン７１とターボチャージャー７２とを接続する排気管７４に設けられたもので、エアバイパスを行ってエンジン７１の排気ガスをターボチャージャー７２を介さず直接外気に排出する状態と、ターボチャージャー７２に供給する状態とを切替えている。

【００２５】図６は排気ガス温度とポスト噴射の有無並びに排気ガス温度維持手段の稼動状態との関係を説明する図である。① "W/o post injection" で示される棒グラフは、ポスト噴射を行わない状態を示しており、排気ガス温度が最も低くなっている。② "W/post injection" で示される棒グラフは、ポスト噴射を行う状態を示しており、排気ガス温度がポスト噴射を行わない状態よりも高くなっているが、ターボチャージャーが稼動するため排気ガス温度の上昇が十分でない。③ "W/post injection & full open VNT or WG" で示される棒グラフは、ポスト噴射を行うと共に、排気ガス温度維持手段によりターボチャージャー１０に設けられた可変ノズル若しくはウェイストゲートバルブ（ＷＧ）を全開する状態を示しており、排気ガス温度が最も高くなっている。ポスト噴射と排気ガス温度維持手段を併用することで、排気ガス温度がパティキュレート・フィルター３０に堆積したパティキュレートを燃焼させて再生できる温度となる。

【００２６】このように構成された装置の動作について、次に説明する。図７は図１の装置の動作を説明する流れ図である。まず、排気ガス浄化制御装置４０はＥＣＵに設けられたパティキュレート・フィルターの再生処理プログラムを一定周期で起動する（Ｓ１００）。パティキュレート・フィルター３０の入口側排気圧と出口側排気圧の差圧（ｄＰ）が所定のしきい値差圧（ｄＰｒ）よりも大きいか判断する（Ｓ１０２）。ここでは、パティキュレート・フィルター３０の入口側排気圧と出口側排気圧の差圧を測定することで、間接的にパティキュレート・フィルター３０のパティキュレート堆積量が所定の閾値を超えたか判断している。

【００２７】次に、ディーゼルエンジン２０の排気ガス温度（Ｔｅ）が所定のポスト噴射開始温度（Ｔｅｒ）よりも低いか判断する（Ｓ１０４）。そして、パティキュレート堆積量が所定の閾値よりも大きく、かつ排気ガス温度がポスト噴射開始温度よりは低い場合に、ディーゼルエンジン２０のポスト噴射を開始する（Ｓ１０６）。次に、ディーゼルエンジン２０の回転数が中速以下且つ低負荷の運転状態であるか判断する（Ｓ１０８）。具体的には、予め実験によって定められた所定燃料噴射量（Ｑｒ）よりもインジェクタ２４による全燃料噴射量（Ｑ）が少なく、且つ、同じく実験によって予め定められた所定エンジン回転数（Ｒｐｍｒ）よりもエンジン回転数（Ｒｐｍ）が少ないか判断している。そして、Ｓ１０８に該当する場合にはターボチャージャー１０に設けられた可変ノズル若しくはウェイストゲートバルブを全開する（Ｓ１１０）。そして、処理を抜ける（Ｓ１１２）。

【００２８】

【発明の効果】以上説明したように、本発明の排気ガス浄化装置は、堆積量判定手段によりパティキュレート・フィルターのパティキュレート堆積量が再生を必要とするかの基準となる所定の閾値を超えたか判断するので、パティキュレート・フィルターを再生すべき時期が的確に判断できる。排気ガス温度判定手段でディーゼルエンジンの排気ガス温度Ｔｅが所定のポスト噴射開始温度Ｔｅｒよりも低いか判断すると共に、ポスト噴射制御手段によりディーゼルエンジンのポスト噴射を開始するので、排気ガス温度をパティキュレート・フィルター再生に好適な温度に保持できる。排気ガス温度維持手段により、ディーゼルエンジンの回転数が中速以下且つ低負荷の運転状態でポスト噴射を実行する場合には、ターボチ

ャージャーの回転数増大を阻止して、ポスト噴射により上昇した排気ガス温度がターボチャージャーで失われないように制御しているので、パティキュレート・フィルターの再生が行える。

【００２９】ディーゼルエンジンの回転数が中速以下且つ低負荷の運転状態として、例えばアイドリング時がある。パティキュレートの発生量は、例えばアイドリング時に約２０［ｍｇ／ｍ³］であるのに対して、最大出力時に約２００［ｍｇ／ｍ³］であり、ディーゼルエンジン車両の運転モードに依存して約１０倍の開きがある。アイドリング時の排気ガス温度は例えば１００～２００℃と、最大出力時の５５０～７５０℃と比較して格段に低温であるが、本発明の実施によりディーゼルエンジンの回転数が中速以下且つ低負荷の運転状態の排気ガス温度をパティキュレート・フィルターの再生ができる温度まで上昇させることができる。そこで、ターボチャージャを備えたエンジンでも、排気温度の低いアイドリング状態や下り坂走行時において、ポスト噴射による熱エネルギーがタービンの回転数を上げる仕事に使われることなく、ポスト噴射により排気温度を触媒の活性温度域まで上げて、強制的にパティキュレート・フィルターを再生することができる。

【図面の簡単な説明】

【図１】　本発明のディーゼルエンジンに用いられる排気ガス浄化装置の実施の形態を説明する構成図である。＊【図２】　インジェクタからディーゼルエンジンの燃焼室に噴射される燃料噴射のタイミングチャートである。

【図３】　ディーゼルエンジンの運転状態の説明図である。

【図４】　可変ブレード式タービンの構成図である。

【図５】　ウェイストゲートバルブによる過給圧調整の説明図である。

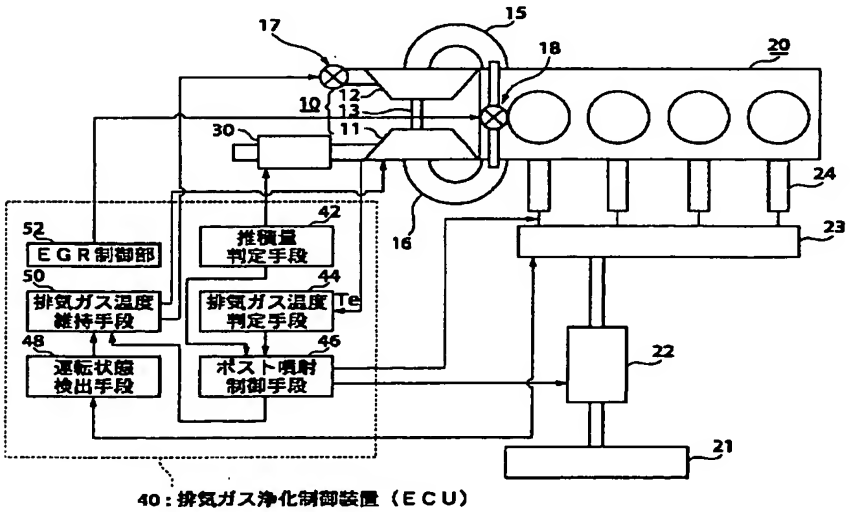
【図６】　排気ガス温度とポスト噴射の有無並びに排気ガス温度維持手段の稼動状態との関係を説明する図である。

【図７】　図１の装置の動作を説明する流れ図である。

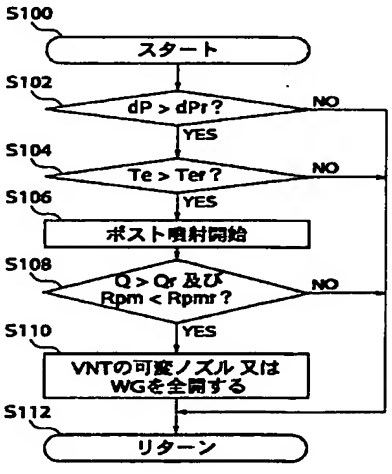
【符号の説明】

１０　ターボチャージャー
２０　ディーゼルエンジン
２１　燃料タンク（Ｆｕｅｌ　Ｔａｎｋ）
２２　ポンプ（Ｐｕｍｐ）
２３　燃料レール（Ｃｏｍｍｏｎ　Ｒａｉｌ）
２４　インジェクタ（Ｉｎｊｅｃｔｏｒ）
３０　パティキュレート・フィルター（ＤＰＦ）
４０　排気ガス浄化制御装置（ＥＣＵ）
４２　堆積量判定手段
４４　排気ガス温度判定手段
４６　ポスト噴射制御手段
４８　運転状態検出手段
５０　排気ガス温度維持手段

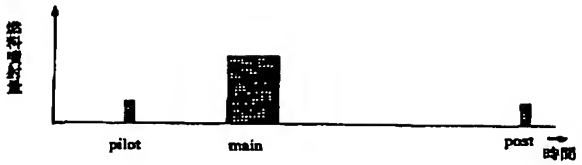
【図１】



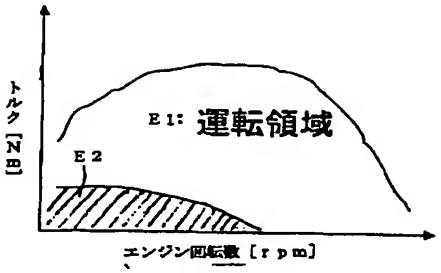
【図７】



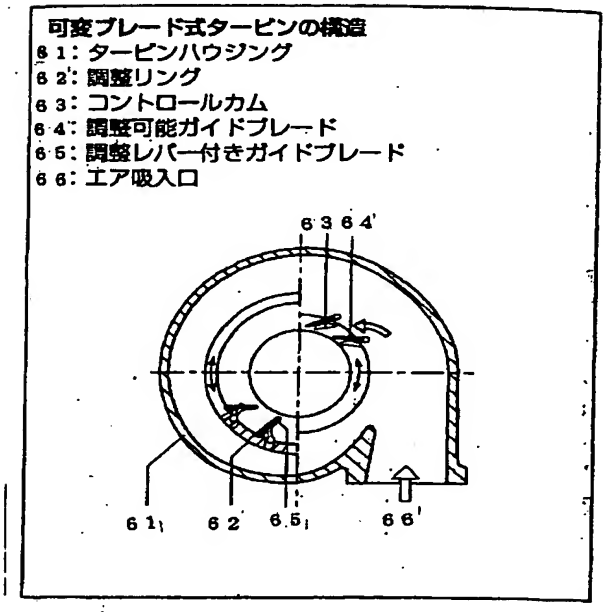
【図２】


燃料噴射量
pilot
main
post
時間

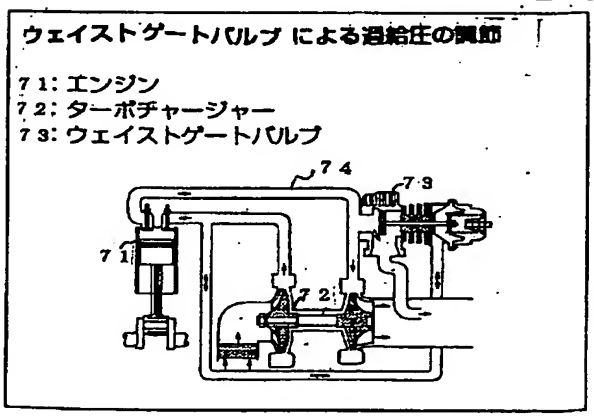
【図３】


トルク［Ｎｍ］
Ｅ１：運転領域
Ｅ２
エンジン回転数［ｒｐｍ］

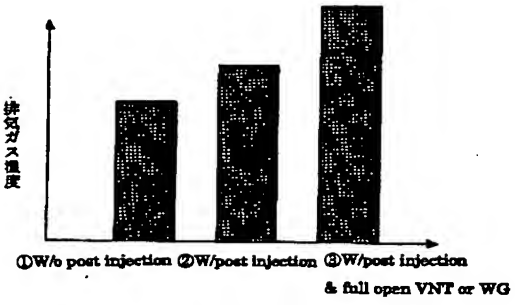
【図４】


可変ブレード式タービンの構造
６１：タービンハウジング
６２：調整リング
６３：コントロールカム
６４：調整可能ガイドブレード
６５：調整レバー付きガイドブレード
６６：エア吸入口
６３
６４
６１
６２
６５
６６

【図５】


ウェイストゲートバルブ による過給圧の調節
７１：エンジン
７２：ターボチャージャー
７３：ウェイストゲートバルブ
７４
７３
７１
７２

【図６】


排気ガス温度
①W/o post injection
②W/post injection
③W/post injection
& full open VNT or WG

フロントページの続き

(51)Int.Cl.'		識別記号
Ｆ０２Ｂ	37/24	
	37/18	
	37/12	３０２
Ｆ０２Ｄ	23/00	
	23/02	
	41/04	３７５
	41/38	
	43/00	３０１
// Ｂ０１Ｄ	46/42	
	46/44	

Ｆ１			テーマコード（参考）
Ｆ０２Ｂ	37/12	３０２Ｄ	３Ｇ０９２
		３０２Ｆ	３Ｇ３０１-
Ｆ０２Ｄ	23/00	Ｐ	４Ｄ０５８
		Ｊ	
	23/02	Ｃ	
	41/04	３７５	
	41/38	Ｂ	
	43/00	３０１Ｈ	
		３０１Ｒ	
Ｂ０１Ｄ	46/42	Ｂ	
	46/44		
Ｆ０２Ｂ	37/12	３０１Ｑ	
		３０１Ｅ	

Ｆターム(参考)
3G005 DA02 EA15 EA16 FA35 GA02 GA04 GB24 GB28 GD12 GD13 GD17 GE09 HA05 HA12 HA18 JA02 JA16 JA39 JA40
3G071 AA10 AB06 BA10 DA01 DA11 FA06 HA05 JA03
3G084 AA01 AA03 BA03 BA08 BA13 BA15 BA20 BA24 CA03 CA09 DA10 EB12 EC03 FA12 FA13 FA17 FA27 FA33 FA37
3G090 BA01 CA01 DA04 DA12 DA18 DA20 DB03 DB07 EA04 EA05 EA06
3G091 AA02 AA10 AA11 AA18 AB02 AB13 BA00 CA01 CB00 CB03 DB10 DC01 EA01 EA03 EA09 EA17 EA32 FA04 FA08 FA12 FA13 FB02 FC07 HA14 HA36 HA37 HA42 HB05 HB06
3G092 AA02 AA17 AA18 AB03 BB13 DB03 DC12 DC14 DF02 EA08 FA18 GA04 GA05 HA17X HB01X HB02X HD01Z HD08Z HD09X HE01Z
3G301 HA02 HA11 HA13 JA24 KA07 KA08 KA23 KA24 LB11 MA11 MA18 MA23 MA27 NA08 ND04 PA16Z PA17Z PB03Z PB05Z PD11Z PD14Z PD15Z PE01Z
4D058 MA41 MA51 NA01 NA05 PA02 SA08